

Application No. 10/606,118
Amendment dated January 11, 2005
Reply to Office Action of August 11, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1-9 (canceled).

Claim 10 (currently amended): A flashlight, comprising:

an illuminator assembly including an LED, a printed circuit board, a flange, and a parabolic reflector;

a lens ~~comprising~~ having a convergent portion, a nonconvergent portion, and a lens flange, wherein the convergent portion is characterized by a focal point; and

a housing conformingly receiving the illuminator assembly so as to contain the illuminator assembly within the housing;

wherein associated circuitry is mounted on the printed circuit board, the associated circuitry configured to provide power to the LED;

wherein the LED ~~is a high-power LED having~~ has a light emitting element, a parabolic micro-reflector and a transparent tip, the LED being mounted in the printed circuit board and configured to emit light from its light emitting element and produce by reflection from the parabolic micro-reflector a divergent beam of light that is characterized by an optical directivity angle extending from a vertex point, and also to produce additional light extending in a direction outside of the divergent beam of light and emanating from the tip of the LED;

wherein the parabolic reflector is connected to the printed circuit board such that the focal point of the parabolic reflector coincides with the transparent tip;

wherein the flange is configured to engage the lens flange to position the LED so that the light emitting element is positioned at the focal point of the convergent portion and the divergent beam is centered on the focal center point of the convergent portion;

wherein substantially all of the divergent beam of light from the LED passes through the convergent lens to emerge in a first beam of parallel light; and

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wherein the parabolic reflector reflects at least a portion of the additional light into a second beam of parallel light that is parallel to the first beam of parallel light and extending through the nonconvergent portion of the lens.

Claim 11 (previously presented): The flashlight of claim 10, and further comprising a body portion defining one or more battery compartments configured to receive one or more batteries, wherein:

the illuminator assembly is conformingly received by the body portion; and

the housing conformingly receiving the body portion so as to contain the body portion within the housing.

Claims 12-16 (canceled).

Claim 17 (currently amended): The flashlight of claim 10, wherein:

the portion of the lens that is convergent comprises a focal center point and is characterized by a convergence diameter D ,

wherein the distance between the focal point and the focal center point defines a focal distance L , and wherein the relationship between the convergence diameter D , the focal distance L , and the optical directivity angle A is described by the relation $D \geq 2L \tan (A/2)$.

Claim 18 (canceled).

Claim 19 (currently amended): The flashlight of claim 10, wherein the directivity angle is about 20° .

Claim 20 (canceled).

Claim 21 (new): The flashlight of claim 10, wherein the non-convergent portion of the lens surrounds the convergent portion of the lens.

Claim 22 (new): The flashlight of claim 10, and further comprising:
a switch;

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at least one battery compartment configured to hold at least one battery, the battery compartment having contacts that are connected in a circuit that includes the LED and the switch such that the switch can close and open the circuit to energize and deenergize the LED when the battery is installed in the battery compartment; and

a housing configured to house the LED, the lens, the switch and the battery compartment.

Claim 23 (new): A flashlight comprising:

a lens having a convergent portion, a nonconvergent portion, and a lens flange, wherein the convergent portion is characterized by a focal point;

an illuminator assembly including an LED, a flange, and a parabolic reflector, the LED having a light emitting element and a transparent tip, and the LED connected to a structure containing circuitry connecting the LED with a battery, wherein the LED emits a divergent beam of light that is characterized by an optical directivity angle extending from a vertex point, and wherein the LED emits additional light extending in a direction outside of the divergent beam of light and emanating from the tip of the LED; and

a housing conformingly receiving the illuminator assembly so as to contain the illuminator assembly within the housing,

wherein the parabolic reflector is connected to the circuitry-containing structure such that the focal point of the parabolic reflector coincides with the transparent tip of the LED,

wherein the flange is configured to engage the lens flange to position the LED so that the light emitting element is positioned at the focal point of the convergent portion of the lens and the divergent beam of light is centered on the focal center point of the convergent portion of the lens,

wherein a beam of light from the LED passes through the convergent portion of the lens to emerge in a first beam of parallel light, and

wherein the parabolic reflector reflects at least a portion of the additional light into a second beam of parallel light that is parallel to the first beam of parallel light and extends through the nonconvergent portion of the lens.

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Claim 24 (new): The flashlight of claim 23, wherein the non-convergent portion of the lens surrounds the convergent portion of the lens.

Claim 25 (new): The flashlight of claim 23, and further comprising:

a switch;

at least one battery compartment configured to hold at least one battery, the battery compartment having at least one contact that is connected in a circuit that includes the LED and the switch such that the switch can close and open the circuit to energize and deenergize the LED when the battery is installed in the battery compartment; and

a housing configured to house the LED, the lens, the switch and the battery compartment.

Claim 26 (new): The flashlight of claim 23, wherein the divergent beam of light passes substantially through the convergent portion of the lens to form a first parallel beam of light.

Claim 27 (new): A flashlight comprising:

an illuminator assembly including an LED, a flange, and a parabolic reflector;

a lens having a convergent portion, a nonconvergent portion, and a lens flange, wherein the convergent portion is characterized by a focal point; and

a housing conformingly receiving the illuminator assembly so as to contain the illuminator assembly within the housing;

wherein the LED has a light emitting element, a parabolic micro-reflector and a transparent tip, and the LED is mounted on a circuit board and configured to emit light from its light emitting element and produce by reflection from the parabolic micro-reflector a divergent beam of light that is characterized by an optical directivity angle extending from a vertex point, and also to produce additional light extending in a direction outside of the divergent beam of light and emanating from the tip of the LED;

wherein the parabolic reflector is positioned such that the focal point of the parabolic reflector coincides with the transparent tip of the LED;

wherein the flange is configured to engage the lens flange to position the LED so that the light emitting element is positioned at the focal point of the convergent portion of the lens

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and the divergent beam is centered on the focal center point of the convergent portion of the lens;

wherein the divergent beam of light from the LED passes through the convergent lens to emerge in a first beam of parallel light; and

wherein the parabolic reflector reflects at least a portion of the additional light into a second beam of parallel light that is parallel to the first beam of parallel light and extending through the nonconvergent portion of the lens.

Claim 28 (new): The flashlight of claim 27, wherein the non-convergent portion of the lens surrounds the convergent portion of the lens.

Claim 29 (new): The flashlight of claim 27, and further comprising:

a switch;

at least one battery compartment configured to hold at least one battery, the battery compartment having at least one contact that is connected in a circuit that includes the LED and the switch such that the switch can close and open the circuit to energize and deenergize the LED when the battery is installed in the battery compartment; and

a housing configured to house the LED, the lens, the switch and the battery compartment.

Claim 30 (new): A flashlight comprising:

a lens having a convergent portion, a nonconvergent portion, and a lens flange, wherein the convergent portion is characterized by a focal point;

an illuminator assembly including a LED, a flange, a mounting structure and a parabolic reflector, the LED characterized by emitting a divergent beam of light, the LED and the parabolic reflector connected to the mounting structure, and the focal point of the parabolic reflector coinciding with a light emitting area of the LED;

a housing conformingly receiving the illuminator assembly so as to contain the illuminator assembly and the lens within the housing;

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wherein the flange is configured to engage the lens flange to position the LED so that the light emitting area of the LED is positioned at the focal point of the convergent portion of the lens,

wherein the divergent beam of light from the LED passes through the convergent portion of the lens to emerge in a first beam of parallel light, and

wherein the parabolic reflector reflects light from the divergent light emitting area of the LED into a second beam of parallel light that is parallel to the first parallel beam and exits through the nonconvergent portion of the lens.

Claim 31 (new): The flashlight of claim 30, wherein the non-convergent portion of the lens surrounds the convergent portion of the lens.

Claim 32 (new): The flashlight of claim 30, and further comprising:

a switch;

at least one battery compartment configured to hold at least one battery, the battery compartment having at least one contact that is connected in a circuit that includes the LED and the switch such that the switch can close and open the circuit to energize and deenergize the LED when the battery is installed in the battery compartment; and

a housing configured to house the LED, the lens, the switch and the battery compartment.

Claim 33 (new): The flashlight of claim 30, wherein the divergent beam of light passes substantially through the convergent portion of the lens to form a first parallel beam of light.